

# NISTTech

## Microfluidic Platform of Arrayed Switchable Spin-Valve Elements for High-Throughput Sorting & Manipulation of Magnetic Particles & Biomolecules

---

**Manipulate and quickly sort many small magnetic particles and biomolecules**

### Description

---

Spin valves, commonly used as magnetic sensors in disk drives, may be used to manipulate individual strands of DNA for high-speed applications such as gene sequencing. Such arrays might be used in chip-scale, low-power microfluidic devices for stretching and uncoiling, or capturing and sorting, large numbers of individual biomolecules simultaneously.

When the spin valves are turned on, a local magnetic field is created that is strongest near the ends of the magnetic stack below the membrane. This field is strong enough to trap nanoscale magnetic particles, and serve as the pivot point for rotating strands of particles when a rotating magnetic field is applied. Spin valve arrays can apply torsional forces strong enough to alter the structure or shape of biomolecules such as proteins or DNA strands. An array of spin valves may selectively sort and transport biomolecules within the array.

See divisional patent application below under citations.

### Applications

---

- **Medical diagnosis and forensic studies**  
Drug screening and gene sequencing
- **Medical research**  
Nucleic acid sequencing and structural control and analysis of RNA/DNA and proteins

### Advantages

---

- **Permits parallel processing of biomolecules**  
Not limited to one molecule at a time
- **Better than optical tweezers**  
Faster and stronger and not limited to large particles
- **Improvement over magnetic tweezers**  
Does not require permanent immobilization of biomolecules

## Abstract

---

Arrays of spin-valve elements that can be selectively activated to trap, hold, manipulate and release magnetically tagged biological and chemical particles, including molecules and polymers. The spin-valve elements that can be selectively activated and deactivated by applying a momentary applied magnetic field thereto. The spin valve element array can be used for selectively sorting and transporting magnetic particles one particle at a time within the array. As the magnetically tagged particles are held by the spin-valve elements, application of an auxiliary magnetic field can be used to apply tension or torsion to the held particles or to move, e.g. rotate, the trapped particles. The arrays of spin-valve elements can be used in a variety of applications including drug screening, nucleic acid sequencing, structural control and analysis of RNA/DNA and proteins, medical diagnosis, and magnetic particle susceptibility and size homogenization for other medical applications.

## Inventors

---

- Mirowski, Elizabeth
- Moreland, John M.
- Russek, Stephen

## Citations

---

1. NIST Docket Number: 04-016 Divisional [U.S. Patent Application # 20070141728](#)

## Related Items

---

- Article: Magnetic Computer Sensors May Help Study Biomolecules
- Video: Spin-Valve Trapped Magnetic Particles

## References

---

- U.S. Patent Application #20050170418
- Docket: 04-016US

## Status of Availability

---

This invention is available for licensing.

Last Modified: 07/19/2011